REMARKS

Claims 23-34, 38-50 and 52-54 are pending.

Claim 23 is combined with Claim 55 to recite the "consisting essentially of" language and to no longer recite Zr and to recite $0<Fe\leq 0.10$. In view of this, dependent Claim 55 is cancelled.

Claim 23 is also amended to recite "the balance essentially aluminum and incidental elements and impurities, <u>which are at most 0.05% per element, 0.15% total</u>" as supported at page 6, paragraph [0069] of the present specification.

Claim 40 is amended to recite the Cu lower level of Claim 39 with the Cu upper level of Claim 23 and the Mg level of Claim 41.

All claim amendments are made without prejudice or disclaimer.

I. <u>Claim Rejection under 35 USC § 112 Rejections</u>

The Office action rejects Claims 23-34, 38-50, 52 and 53 under 35 USC §112, second paragraph. The Office action asserts the language "essentially free of Mn" is unclear.

In response, claim 23 is amended to remove the phrase "essentially free of Mn". The invention as now presented has no reference to Mn content. Thus, Mn can only be present as an "incidental element or impurity." Thus, Mn can be present to a level of <0.05 as defined in paragraph [0069] of the present application. Such low level Mn is also consistent with paragraph [0072] reading that in a preferred mode: "Mn is in a range of incidental elements and impurities. That means that the amount of Mn should be 0 or at least neglectable."

Thus, it is respectfully submitted this rejection is overcome.

II. <u>35 USC § 101</u>

Claim 55 is rejected for reciting a use without method steps.

The claim is a dependent method claim which narrows the composition of the base method claim. Thus, it is respectfully submitted this rejection is overcome.

III. 35 USC § 103

A. Claims 23-30, 32-34, 38-50, 52, 53 and 55

The Office action of December 14, 2006 rejects Claims 23-30, 32-34, 38, 40-50, 52, 53 and 55 under 35 USC § 103(a) as allegedly being unpatentable over US 6,563,154 to Rioja et al. alone or optionally in view of Dif et al. (US 2004/0079455 A1).

A comparison of the composition windows of Rioja et al. and Dif et al. and present amended claim 23 is provided below.

fice action asserts Rioja et al. (col. 5, lines 5-7, 16-18, claim 6) teaches a process of casting, working, and heat treating an Al-Cu alloy comprising: 3.4-4.0% Cu, 1.0-1.6% Mg, 0-0.4% Mn, 0.09-0.12% Zr, up to 1% Si, up to 1% Fe. The Office action also asserts Rioja et al. (col. 5, lines 5-7, col. 4, lines 60-64) teaches an Al-Cu alloy with 3.5-4.5% Cu, 0.6-1.6% Mg, 0.3-0.7% Mn, 0.08-0.13% Zr, up to 1% Si, up to 1% Fe. Dif et al (paragraphs [0007-0008] and claims 1 and 6) Cu: 3.6 - 4.5 Mn <0.05 (< 0.01 in claim 6) Mg 1.0 - 1.6 Zr 0.08 - 0.2 Si < 0.09 Fe < 0.08	Present Amended Claim 23: casting an ingot [[comprising]] <u>consisting essentially of</u> (wt. %) Cu: 4.3 - 4.9 Mg: 1.0 - 1.8 Si: [[0.10 - 0.40]] <u>0.23 to 0.30</u> [[Zr: ≤ 0.15]] Cr: ≤ 0.15 [[Fe:]] <u>0< Fe</u> ≤ 0.10, the balance essentially aluminum and incidental elements and impurities, <u>which are at most 0.05% per element, 0.15% total,</u> ~~wherein the alloy product is essentially Mn-free and comprises Fe~~ a) wherein the ingot is cast by semi-continuous direct chill (DC) casting, b) homogenizing and/or pre-heating the ingot after the casting step, c) hot rolling the homogenized and/or pre-heated ingot and optionally cold rolling into a rolled product, d) solution heat treating the hot rolled product, e) quenching the solution heat treated product, f) stretching the quenched product, and g) naturally ageing the stretched, rolled and heat-treated product.

1. Rioja et al.

As stated in the above table, the Office action of December 14, 2006 asserts Rioja et al. teaches a process of casting, working, and heat treating an Al-Cu alloy comprising: 3.4-4.0% Cu, 1.0-1.6% Mg, 0-0.4% Mn, 0.09-0.12% Zr, up to 1% Si, up to 1% Fe.

The Office action also asserts Rioja et al. teaches an Al-Cu alloy with 3.5-4.5% Cu, 0.6-1.6% Mg, 0.3-0.7% Mn, 0.08-0.13% Zr, up to 1% Si and up to 1% Fe.

a. Mn Level

The Office Action asserts Rioja et al. teaches an alloy having elemental percentages which overlap the percentages recited by the present claims with the exception that "Rioja does not teach the elevated range of Cu combined with a[n] amount of very low Mn amount, such as <0.1%".

It is respectfully submitted the fact that "Rioja does not teach the elevated range of Cu combined with a[n] amount of very low Mn amount, such as <0.1%" is sufficient for the present invention to distinguish over the reference. It is respectfully submitted the above-mentioned second alloy of Rioja et al. implies that if sufficiently high level of Cu is employed to approach or overlap the 4.3-4-9 range of present Claim 23 then a Mn level higher than that of present Claim 23 is employed.

Thus, Applicant's assert the presently claimed alloy has Zr and Mn at most as an incidental element or impurity at a level of at most 0.05% each, 0.15% total to distinguish over Rioja alone or combined with Dif.

Claim 39 reciting 4.4 to 4.5% Cu further distinguishes over Rioja et al. because it has a Cu level further above that of the above-mentioned second Al-Cu alloy of Rioja et al. with very low Mn.

b. Zr Level

The first alloy of Rioja et al. relied upon by the Office action is for Al-Cu aluminum sheet products containing Zr in a range of 0.09 to 0.12%. The second alloy relied upon by the Office action Rioja et al. has Zr in a range of 0.08-0.13%. Such Zr-levels are outside the present claims which, as mentioned above, permit Zr as an incidental element or impurity.

c. Si level

The introduction of 0.23 to 0.30 % Si into base Claim 23 further distinguishes the present invention over the cited prior art documents. This makes the data for Alloy 2 listed in the Table 1 at page 9 of the present specification further commensurate in scope with Claim 23.

The Office Action refers to Rioja et al. as teaching in col. 5, lines 15-22 the addition of up to 1% Si for the formation of strengthening precipitates. However, all the examples in Rioja et al. have a very low Si-content in the range of 0.00 to 0.04% (see Tables 1 and 2). Rioja et al. does not illustrate the effect of Si as strengthening element. Likewise, the examples in the present application do not indicate the effect of Si as a strengthening element. Thus, it is respectfully submitted Rioja et al. as a whole teaches aluminum sheet products for aerospace use and emphasizes the aluminum alloy has Si as an impurity element to a maximum of 0.2%, and typically less than 0.04%.

Moreover, this teaching of Rioja et al. is consistent with Dif et al. (US2004/0079455A1) which teaches a Si-content of <0.09%.

Also, this teaching of Rioja et al. is consistent with the teaching of Cassada III (US-5,593,516) which teaches Si content up to 0.10%, and preferably up to 0.06%. Therefore, the teachings of each of Rioja et al. and Dif et al. and Cassada III are consistent with present paragraph [0070] mentioning that in current aerospace grade materials the Si-content is typically <0.10, and preferably <0.07%.

Thus, the presently claimed invention distinguishes over Rioja et al. and withdrawal of this ground of rejection is respectfully requested.

2. Rioja et al. in view of Dif et al.

The Office Action in paragraph 5 asserts the combination of Rioja et al. and Dif et al. (US2004/0079455A1) would lead to the claimed subject matter.

Rioja et al. does not teach the elevated range of Cu combined with an amount of very low Mn, such as < 0.1%. Thus, Dif et al. is relied upon as teaching Al-Cu-Mg alloys that are substantially Mn-free and contain 3.6-4.5% Cu exhibit a good compromise between strength and toughness (see paragraphs [0007] and [0008]).

Thus, the Office action asserts it would have been obvious to have an Al-Cu alloy with

elevated Cu and low Mn, as taught by Dif et al., for the process of casting, heat treating and working an Al alloy as taught by Rioja et al. because Dif et al. teaches added Cu achieves excellent mechanical properties (Page 1) and low Mn is beneficial for a good compromise between strength and toughness.

a. Zr Level

Applicant's assert the presently claimed alloy has Zr and Mn at most as an incidental element or impurity at a level of at most 0.05% each, 0.15% total to distinguish over Rioja alone or combined with Dif.

Dif et al. requires addition of Zr in the range of 0.08-0.20%, or preferred narrower ranges, see paragraphs [0007], [0046], [0047] to compensate for the lack of Mn. Thus, the combined teaching of Rioja et al. and Dif et al. would also lead the skilled person to an AlCu alloy having less than 0.09% Si and with the purposive addition of Zr at a level of more than 0.08%. This is the opposite of the direction followed by the present invention. The alloy product according to the present invention does not have Zr other than as inevitable impurity, meaning that it should be less than 0.05%.

b. Mn Level

Dif et al. replaces Mn with zirconium or zirconium plus scandium. Paragraph [0010] of Dif et al. states, "According to embodiments of the present invention, manganese has been totally replaced by zirconium or by zirconium + 300 µg/g of scandium."

In contrast, Claim 23 lacks added zirconium and scandium. Thus, the motivation to omit Mn of Dif et al. is irrelevant to this claim and there is no reason to combine the references to arrive at the invention of this claim.

Claims 52 and 53 recite 0% Mn, with the exception of unavoidable impurities, and further emphasize a lack of added zirconium, scandium and Mn. Dif et al. does not suggest reducing the Mn level to 0% with only "incidental levels or impurity levels" when the Cu level is in the range of 4.3-4.9 %. Also, Dif et al. does not teach or suggest Alloy 1 of the present invention, having 4.4 % Cu, 0% Mn, 0% Zr, 1.68% Mg and 0.25% Si, has comparable UTS and superior fatigue crack growth rate to the AA2024 and AA2524 alloys as shown by data at pages 10 and 11 of the present application.

c. Si Levels

As stated above, the Office Action refers to Rioja et al. as teaching in col. 5, lines 15-22 the addition of up to 1% Si for the formation of strengthening precipitates. However, as also stated above, it is respectfully submitted that Rioja et al. as a whole emphasizes aluminum sheet products for aerospace use and the aluminum alloy has Si only as impurity element to a maximum of 0.2%, and typical values of less than 0.04%. Thus, it emphasizes an impurity element and not a purposive alloying element up to 1%.

Furthermore, the combination of the teachings of both documents would lead the skilled person to an aluminum alloy product having <0.09% Si, to be consistent with the teaching of Rioja et al. Such lower Si-content is the opposite of the present invention having the purposive addition of Si in a range of 0.23-0.30%.

d. Applicant's Priority Date

As argued in Applicants' reply of September 22, 2006 the July 9, 2003 filing date of Dif et al. is after the August 20, 2002 priority date of the present application.

It is respectfully submitted present amended claim 23 is also entitled to the priority date of its priority document EP 02078444.3 as shown in the following table. Thus, Dif et al. is not a reference against present Claim 23.

Present Claim 23	**Support in EP 02078444.3 (Priority Document) filed August 20, 2002**
A method of producing a balanced Al-Cu-Mg-Si alloy having a high toughness, good strength levels and an improved fatigue crack growth resistance, comprising the steps of:	Claim 7
a) casting an ingot consists essentially of the following composition (in weight percent): Cu: 4.3 - 4.9 Mg: 1.0 - 1.8 Si: 0.15 to 0.35 Cr: ≤ 0.15 0 < Fe ≤ 0.10, the balance essentially aluminum and incidental elements and impurities,	Claim 7, with Cu lower limit of page 7, line 13, the change from "consisting" language to "consisting essentially of" language is not new matter; Claim 7 recited Fe: ≤ 0.10. Table 1 discloses 0 % Zr.
wherein the ingot is cast by semi-continuous direct chill (DC) casting,	Claim 7
b) homogenizing and/or pre-heating the ingot after the casting step,	Claim 7
c) hot rolling the homogenized and/or pre-heated ingot and optionally cold rolling into a rolled product,	Claim 7
d) solution heat treating the hot rolled product,	Claim 7
e) quenching the solution heat treated product,	Claim 7
f) stretching the quenched product, and	Claim 7
g) naturally ageing the stretched, rolled and heat-treated product.	Claim 7

Page 4 of the Office action asserts paragraph [0007] of Dif et al. teaches Al-Cu-Mg alloys that are substantially Mn-free and contain 3.6-4.5% Cu and paragraph [0008] of Dif et al. teaches these alloys exhibit a good compromise between strength and toughness.

Thus, an issue is whether these teachings are in provisional application no. 60/394,234 (the '234 application) filed July 9, 2002 from which Dif et al. claims priority. The '234 application discloses a Mn-free alloy including 3.6-4.5% Cu (paragraph bridging pages 3 and 4). Paragraph [0008] of Dif et al. is not in the '234 application. However, the '234 application does present fracture toughness and static tensile properties.

Also, the alloys of Dif et al. and the '234 application have 0.08-0.20% or 0.08-0.14% Zr.

Page 1 of the '234 application says, "According to embodiments of the present invention, manganese has been totally replaced by zirconium or by zirconium + 300 ppm of scandium." In contrast, as mentioned above, the present alloys do not have added Zr.

e. Dependent Claim 54

Claim 54 recites a lower limit of Mg of 1.68% as supported Table 1 at page 9 of the present specification. Rioja et al. and Dif et al. neither teach nor suggest such a Mg percentage range. Thus, Applicants respectfully submit this claim further distinguishes over the cited references.

B. Claim 31

Claim 31 stands rejected as being unpatentable over Rioja et al. or Cassada, III as applied to Claim 23 and further in view of "Metals Handbook Desk Edition" p. 445-446. Applicants respectfully assert the same arguments for Claim 31 as asserted for its base Claim 23.

C. Cassada, III (US 5,593,516)

The Office Action rejects Claims 23, 24, 26-30, 32-34, 38-41, 45-50, and 52-55 under 35 USC §103(a) as being unpatentable over Cassada, III (US 5,593,516).

The Office Action asserts Cassada, III teaches an aluminum based alloy sheet (typically 0.400 in. thick, col. 7 line 16) with 2.5-5.5% Cu, 0.1 - 2.3% Mg, up to 0.15% Fe, up to 0.10% Si, up to 0.20% Zr, up to 0.05% Ti (Cassada claims 1,2,6) which overlaps the presently claimed alloying ranges of Cu, Mg, Si, Fe, Mn and Zr (cl. 23, 38-41, 45, 50, 52-55)." The Office Action also asserts, "Cassada teaches that Zr replaces Mn as a grain growth and recrystallization inhibitor in said composition (column 5 lines 57-61), because Mn lowers the fracture toughness". Thus, the Office Action asserts "[b]ecause Cassada teaches a process of working and heat treating an Al-Cu-Mg alloy that overlaps or touches the boundary of the presently claimed alloying ranges, then it is held that Cassada has created a prima facie case of obviousness of the presently claimed invention." Thus, the Office Action asserts there is an overlap with the presently claimed alloying ranges, including up to 0.10% Si.

Although the Office action cited a Si range of up to 0.10% Si, Cassada, III, Table 1 discloses a broad range of up to 0.25% Si.

1. The Present Invention Has Combinations of Cu and Mg Levels Prohibited

by Cassada, III

The present invention achieves unexpected results by selecting an Al-Cu-Mg alloy with no Mn, no Zr and the presence of Si. Cassada, III teaches away from the presently claimed combination of copper and magnesium levels.

The main thrust of Cassada. III is to control copper and magnesium levels. The Abstract discloses the alloy consists essentially of 2.5-5.5 percent copper, 0.10-2.30 percent magnesium, with minor amounts of grain refining elements, dispersoid additions and impurities and the balance aluminum. However, the broad range of Cu cannot be used with the entire broad range of Mg.

Cassada, III discloses, "The amounts of copper and magnesium are controlled such that the solid solubility limit for these elements in aluminum is not exceeded." (Abstract; See also col. 4, first paragraph). This is accomplished by using copper and magnesium only in the portion of the Figure 1 between the Solid Solubility Limit and the Alloy Composition Lower Limit.

These limits are defined by formulas, namely those disclosed by Claim 1 and col. 4 of Cassada, III.

Cu max = -0.91 Mg + 5.59; and

Cu min = -0.91 Mg + 4.59.

Using the solubility equations results in calculations as follows:

Amended Claim 23 recites 4.3 - 4.9% Cu and 1.5 - 1.8% Mg;

Cu max = -0.91 (1.5) + 5.59 = 4.22%; and

Cu min = -0.91 (1.8) + 4.59 = 2.95%.

Thus, for the recited Mg level there is no overlap of the Cu level of Claim 23 with the permitted Cu range of Cassada, III.

Applying the same calculation methodology results in the following values:

Dependent Claim 38 recites 4.3 - 4.6% Cu and 1.5 - 1.8% Mg.

Cu max =4.22%; Cu min =2.95%; thus there is no overlap with Cassada, III.

Dependent Claim 39 recites 4.4 - 4.5% Cu and 1.5 - 1.8% Mg.
Cu max =4.22%; Cu min =2.95%; thus there is no overlap with Cassada, III.

Dependent Claim 40 recites 4.4 - 4.9% Cu and 1.5 to 1.7% Mg.
Cu max =4.22%; Cu min =3.04%; thus there is no overlap with Cassada, III.

Dependent Claim 41 recites 4.3 - 4.9% Cu and 1.5 - 1.7% Mg;.
Cu max =4.22%; Cu min =3.04%; thus there is no overlap with Cassada, III.

Dependent Claim 54 recites 4.3 - 4.9% Cu and 1.68-1.8% Mg.
Cu max =4.06%; Cu min =2.95%; thus there is no overlap with Cassada, III.

Cassada, et al, cols. 3 and 4 explains why this control is necessary. For example:

"The aluminum-based alloy of the present invention consists essentially of 2.5-5.5 percent by weight copper, 0.10-2.3 percent by weight magnesium, and the balance aluminum, and wherein the total amount of magnesium and copper is such that the solid solubility limit of the alloy is not exceeded."
Col. 3, lines 20-26.

"In one aspect of the invention, the aluminum-based alloy has the major solute elements of copper and magnesium controlled such that the solubility limit is not exceeded. In this embodiment, an alloy is provided having higher toughness than prior art alloys as a result of a lower volume percent second phase (VPSP) due to lower copper content.

It has been discovered that combinations of both high strength and high toughness are obtained in the alloy of the present invention by controlling the range of composition of the solute elements of copper and magnesium such that the solid solubility limit is not exceeded. As a result of this controlled

compositional range, an inventive alloy is provided with levels of strength that are comparable with those of prior art alloys but with improved fracture toughness or damage tolerance.

For the inventive alloy, the high strength and high toughness properties are based upon maximizing the copper and magnesium additions such that all of the solute, i.e. copper plus magnesium, is utilized for precipitation of the strengthening phases. It is important to avoid any excess solute that would contribute to the second phase content of the material and diminish its fracture toughness. In theory, the maximum solute level, copper plus magnesium, should be held to this solubility limit. This limit is described in weight percent by the equation:

(1) $Cu_{max} = -0.91(Mg) + 5.59$

Therefore, an alloy containing 0.1 weight percent magnesium can contain 5.5 maximum weight percent copper without producing undesirable insoluble second phase particles. Similarly, at 2.3 percent by weight magnesium, the maximum copper would be 3.5 weight percent.

In practice, the solute levels must be controlled to just below the solubility limit to avoid second phase particles. This level of control must be done as a result of conventional processing techniques for making these types of alloys. In conventional casting of these types of alloys, microsegregation of copper in the ingot results in local regions of high copper content. If the bulk copper level is close to the solubility limit, these regions will exceed the solid solubility limit and contain insoluble second phase particles."

Col. 3, line 51 - Col. 4, line 27.

Thus, Cassada, III teaches away from the combinations of Cu and Mg levels of Claim 23 and the other above-mentioned claims which recite Cu above that permitted by Cassada, III when coupled with the recited Mg ranges.

D. Cassada, III in view of Rioja et al

Claim 25 stands rejected as being unpatentable over Cassada, III in view of Rioja et al. It is respectfully submitted Rioja et al. does not make up for the above-described deficiencies of Cassada III.

IV. Conclusion

In view of the above, it is respectfully submitted that all objections and rejections are overcome. Thus, a Notice of Allowance is respectfully requested.

Please charge any fee deficiency or credit any overpayment relating to this Amendment to Deposit Account No. 19-4375.

Respectfully submitted,

/anthony p venturino/

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